Claims

What is claimed is:

1. A method for evaluating the performance of cellular network handoff decisions comprising the steps of:

    a) creating a reference cellular network description, said reference cellular network description describing:

        i) a cellular network geometry;

        ii) a signal propagation description;

        iii) at least two base stations, each of said at least two base stations having:

            (1) a location within said cellular network geometry; and

            (2) a pilot signal having a pilot signal strength; and

        iv) at least one mobile unit capable of:

            (1) moving along a trajectory; and

            (2) sampling said pilot signal strength; and

    b) creating reduced geometric structures from said reference cellular network description;

    c) representing a general trajectory for said mobile unit in said reference cellular network description;

    d) approximating said general trajectory with a piecewise path having a multitude of handoff decision points;

    e) selecting a handoff mechanism;

    f) selecting handoff parameters;

    g) creating a discrete-time formulation characterizing handoff behaviors; and

h) calculating at least one handoff performance metric along at least one said handoff decision point.

2. A method according to claim 1, wherein at least one of said at least one handoff performance metric includes:

   a) an assignment probability;

   b) a handoff probability;

   c) a mean number of handoff value;

   d) a crossover point;

   e) an outage probability;

   f) a macrodiversity degree; and

   g) an overall signaling load incurred by said handoff mechanism.

3. A method according to claim 1, wherein said cellular network geometry includes at least one of the following:

   a) a hexagonal cell pattern;

   b) a diamond cell pattern;

   c) a square cell pattern;

   d) a rhombus cell pattern; and

   e) a star pattern.

4. A method according to claim 1, wherein said cellular network geometry includes cells mapped into at least one reduced geometric structure.

5. A method according to claim 4, wherein said cellular network geometry includes reduced geometric structures mapped into at least one minimum geometric structure.

6. A method according to claim 1, wherein said signal propagation description includes at least one of the following components:

    a) a path loss component;

    b) a shadow fading component; and

    c) a fast fading component.

7. A method according to claim 1, wherein said piecewise path is a piecewise linear path.

8. A method according to claim 1, wherein said step of selecting a handoff mechanism includes selecting a hard handoff mechanism.

9. A method according to claim 1, wherein said step of selecting a handoff mechanism includes selecting a soft handoff mechanism.

10. A method according to claim 1, wherein said step of selecting a handoff mechanism considers at least one of the following:

    a) assignment regions;

    b) relative pilot signal strengths; and

    c) relative processed signal strengths.

11. A method according to claim 1, wherein said handoff parameters include at least one of the following:

    a) a hysteresis value;

    b) a drop timer value;

    c) an averaging parameter; and

    d) a handoff decision interval.

12. A method according to claim 1, wherein said step of calculating at least one handoff performance metric along at least one said handoff decision point uses a recursive procedure.

13. A cellular network handoff modeler comprising:

    a) a reference cellular network description generator, capable of generating a reference cellular network description, said reference cellular network description describing:

        i) a cellular network geometry;

        ii) a signal propagation description;

        iii) at least two base stations, each of said at least two base stations having:

            (1) a location within said cellular network geometry; and

            (2) a pilot signal having a pilot signal strength; and

        iv) at least one mobile unit capable of:

            (1) moving along a trajectory; and

            (2) sampling said pilot signal strength; and

b) a reduced geometric structure creator, capable of creating reduced geometric structures from said reference cellular network description;

c) a general trajectory generator, capable of representing a general trajectory for said mobile unit in said reference cellular network description;

d) a piecewise path creator capable of approximating said general trajectory with a piecewise path having a multitude of handoff decision points;

e) a handoff mechanism selector;

f) handoff parameters selector;

g) a discrete-time formulation creator capable of characterizing handoff behaviors; and

h) a handoff performance metric calculator capable of calculating at least one handoff performance metric along at least one said handoff decision point.

14. A method according to claim 13, wherein at least one of said at least one handoff performance metric includes:

a) an assignment probability;

b) a handoff probability;

c) a mean number of handoff value;

d) a crossover point;

e) an outage probability;

f) a macrodiversity degree; and

g) an overall signaling load incurred by said handoff mechanism.

15. A method according to claim 13, wherein said cellular network geometry includes at least

one of the following:

a) a hexagonal cell pattern;

b) a diamond cell pattern;

c) a square cell pattern;

d) a rhombus cell pattern; and

e) a star pattern.

16. A method according to claim 13, wherein said cellular network geometry includes cells

mapped into at least one reduced geometric structure.

17. A method according to claim 16, wherein said cellular network geometry includes reduced

geometric structures mapped into at least one minimum geometric structure.

18. A method according to claim 13, wherein said signal propagation description includes at least

one of the following components:

a) a path loss component;

b) a shadow fading component; and

c) a fast fading component.

19. A method according to claim 13, wherein said piecewise path is a piecewise linear path.

20. A method according to claim 13, wherein said handoff mechanism selector is capable of selecting a hard handoff mechanism.

21. A method according to claim 13, wherein said handoff mechanism selector is capable of selecting a soft handoff mechanism.

22. A method according to claim 13, wherein said handoff mechanism selector considers at least one of the following:

    a) assignment regions;

    b) relative pilot signal strengths; and

    c) relative processed signal strengths.

23. A method according to claim 13, wherein said handoff parameters include at least one of the following:

    a) a hysteresis value;

    b) a drop timer value;

    c) an averaging parameter; and

    d) a handoff decision interval.

24. A method according to claim 13, wherein said handoff performance metric calculator uses a recursive procedure.